REMARKS

This application has been reviewed in light of the Office Action dated January 9, 2007. Claims 1-33 are pending in the application. By the present amendment, claims 1, 7, 14, 20 and 26 have been amended and new claims 32 and 33 have been added. No new matter has been added. The Examiner's reconsideration of the rejection in view of the foregoing amendments and the following remarks is respectfully requested.

By the Office Action, claims 1, 5-7, 11, 12, 20, 24 and 25 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Benesty et al. (US Patent No. 6,826,284) (hereinafter "Benesty") or Schau et al., "Passive source localization employing intersecting spherical surfaces from time-of-arrival differences," August, 1987, Acoustics, Speech, and Signal Processing, IEEE Transactions Volume 35, Issue 8, pages 1223-1225 (hereinafter "Schau et al.") in combination with D. Garreau, "Multiscale Inverse Filtering," Conference Proceedings; April 3, 1990, pages 2495-2498, IEEE (hereinafter "Garreau").

Before addressing the Examiner's rejection, applicant summarizes the present principles. The present application teaches "locating an object producing an acoustic wave" (claim 1). This object may be either stationary, moving (see, e.g., page 4, line 31), or in flight (claim 26). "[T]he acoustic wave being detected by a plurality of passive acoustic detectors formed in an array to produce at least three signals" (claim 1). This array of passive acoustic detectors need not be in any particular configuration and does not need to be planar (see, e.g., page 3, line 31 to page 8, line 18). A wavelet is determined "that correlates with each of the at least three signals, said wavelet being

derived from an acoustic wave of a known form" (claim 1). While the wavelet is derived from an acoustic wave of a known form, the at least three signals do not have a known shape. By correlating the three signals with one wavelet (see page 15, lines 27-31), the time difference between the signals can be determined as the three signals are shifted versions of the wavelet (see page 10, lines 12-28). Time difference of arrival (TDOA) measurements are determined "between the at least three signals using correlation intensity with said wavelet" (claim 1). Thus, by determining the correlation of each signal with the wavelet (e.g. by time between points of peak correlation, see page 16, lines 1-6), the time difference of arrival for all signals can easily be determined since all three signals are being compared to a single wavelet. Acoustic reciprocity is performed "at a pre-determined time interval from each of the plurality of detectors based on said TDOA measurements resulting in a hemisphere centered around each of the plurality of detectors" (claim 1). These hemispheres are centered over each of the detectors that detected the acoustic wave and are systematically expanded at pre-determined time intervals to determine a point of intersection of all three hemispheres (claim 1 steps (d) and (e)). These time intervals are based on the time differences of the at least three signals determined by the wavelet (see page 14, line 17 – page 15, line 6).

Benesty teaches "real-time passive acoustic source localization for video camera steering" (see abstract, lines 1-2) and is primarily concerned with acoustic location in reverberant environments (see Col. 3, lines 12-14). As conceded by the Examiner, Benesty does not use wavelets to determine time difference between signals but rather details a very complicated procedure between Col. 5, line 56 and Col. 7, line 54 for

determining the time difference between two signals in a reverberant environment. This additional complexity in determining the time difference between signals results from the signal being produced in a reverberant environment (see Col. 4, lines 47-54). Benesty further teaches the use of a number of different techniques for locating the object once the time difference between signals is determined, one of these techniques being spherical intersection (see Col. 11, line 10 to Col. 12, line 43). However, Benesty does not teach or suggest the use of any other shape in lieu of spheres to locate the object with the intersection technique.

Schau et al. teaches "passive source localization using time-of-arrival difference signals from multiple sensors" (see page 1223, right column). In Schau et al. four (4) sensors produce four (4) signals that are used in determining the location of the source of the signals (see page 1224, left column). As with Benesty, as conceded by the Examiner, Schau et al. also does not use wavelets to determine time difference between signals but rather takes the rudimentary approach of determining differences between all possible pairs of the four signals (see page 1224, left column). Schau et al. then takes these determined differences and uses spherical intersection to locate the source of the signals (see page 1224, left column). As such, it is clear that Schau et al. does not teach or suggest the use of any other shape in lieu of spheres to locate the object with the intersection technique.

Garreau teaches general theory of wavelets and the manner in which they can be used to detect stationary transient signals, i.e. to determine the present of signals. Garreau focuses only on transient signals, which are signals caused by a sudden change in

conditions that persist for a relatively short time after the change (see page 2495, left column). Such transient signals examined by Garreau are stationary in nature. Garreau teaches how "to detect these transients and to estimate their arrival times, given the a priori shape" (see page 2495, right column). Thus, Garreau relies on a knowledge of the a priori shape of the transient signal to detect the signal, not to locate a source of the signal in 3-dimensional space. The wavelets in Garreau are not used to locate moving transient signals, i.e. determine the position of the signals but to simply detect the presence of the transient signals.

Assuming, arguendo, the teachings of Garreau were used with Benesty, the aim in Benesty of an acoustic location method "for use in reverberant environments" (see Col. 3, lines 12-14) would not be met, as the complicated method in Benesty for determining time difference between signals is required due to the reverberant environment (see Col. 4, lines 47-54). Whereas Garreau is not concerned with reverberations of the received signals. Likewise, the aim of Garreau to "detect these transients" (see page 2495, right column) would not be met since the simple detection of the signals is not an aim of the method in Benesty. Since Garreau requires knowledge of the shape of the transient signal, such a method would not work in Benesty, as a reverberant environment adds significant complexity to the signals. Further, Garreau is for use with *stationary* transient signals whereas Benesty locates a moving object using moving signals. As such, Garreau cannot be used to modify Benesty. Finally, even if Garreau could somehow modify Benesty, Benesty still relies on spherical intersection in lieu of hemispherical intersection.

Such hemispherical intersection reduces the computational cost of implementing an intersection method versus spherical intersection.

If Garreau were used with Schau et al., then the resulting method would be useable only on for a *stationary* transient signal for which there was a priori knowledge of the shape of the signal (as required by Garreau). Schau et al. desires to locate an object using acoustic signals where Garreau simply wants to detect the presence of stationary transient signals. As such, one of ordinary skill in the art cannot combine the teachings of Garreau with Schau et al to arrive at the applicant's claimed invention. Finally, even if Garreau could somehow modify Schau et al., Schau et al. still relies on spherical intersection in lieu of hemispherical intersection.

Accordingly, as discussed above, Garreau cannot be combined with either Benesty or Schau et al. because the combination would change the principle of operation of Benesty and Schau et al. In addition, even if Garreau can be combined with either Benesty or Schau et al., none of the cited references taken singularly or in any combination disclose or suggest at least hemispherical intersection, as stated above.

Claim 1 is directed to a method of locating an object producing an acoustic wave, the acoustic wave being detected by a plurality of passive acoustic detectors formed in an array to produce at least three signals, the method comprising, *inter alia*: "examining hemispheres produced from step (c) to determine an intersection point of at least three hemispheres;" and "repeating (c) and (d) with a further time interval to increase the size of said hemispheres if said intersection point is not determined" As discussed above, claim 1 is distinguished from the prior art references because none of the cited references taken singularly or in any

combination disclose or suggest at least hemispherical intersection.

Similar arguments can be made regarding claims 7 and 20. Claim 7 includes a method of locating an object producing an acoustic wave by passive detection of the acoustic wave, the method comprising, *inter alia*: "examining hemispheres produced from step (c) to determine an intersection point of at least three hemispheres at each of said time intervals." As stated above, the prior art references taken singularly or in any combination fail to disclose or suggest at least hemispherical intersection.

Claim 20 includes a computer readable medium having stored thereon computer-executable instructions for locating an object producing an acoustic wave, the acoustic wave being detected by a plurality of passive acoustic detectors formed in an array, the computer-executable instructions comprising, *inter alia*: "examining hemispheres produced from step (c) to determine an intersection point of at least three hemispheres" and "repeating (c) and (d) with a further time interval to increase the size of said hemisphere if said intersection point is not determined." Claim 20 is distinguished from Benesty or Schau et al. in combination with Garreau, as the references taken singularly or in any combination fail to disclose or suggest at least hemispherical intersection.

Accordingly, for at least the reasons stated above, claims 1, 7 and 20 are believed to be in condition for allowance. Claims 5-6, 11-12 and 24-25 are believed to be in condition for allowance due at least to their dependencies from claims 1, 7 and 20, respectfully.

The Applicant notes with appreciation the allowability of claims 2 and 13 if rewritten in independent form including all of the limitations of the base claim and any intervening claims. New claims 32 and 33 correspond to claims 2 and 13, respectfully, rewritten in

independent form including all of the limitations of the base claim and any intervening claims.

In view of the foregoing amendments and remarks, it is respectfully submitted that all the claims now pending in the application are in condition for allowance. Early and favorable reconsideration of the case is respectfully requested.

It is believed that additional fees or charges are due as a result of the addition of two independent claims, which may be charged to Deposit Account No. 50-1433. However, in the event that any additional fees or charges are required at this time in connection with the application, they may also be charged to Deposit Account No. 50-1433.

Respectfully submitted,

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